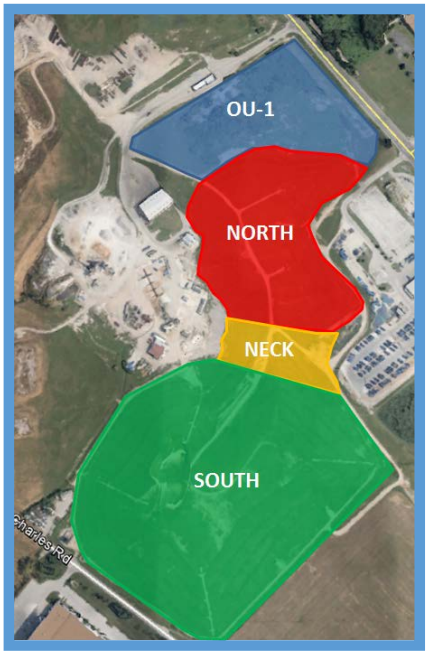
Bridgeton Landfill Data Review Update

Primarily Reflects Data and Documents Published on MDNR's Webpage for data collected in May 2016

Introductory Remarks



The ORD Engineering Technical Support Center (ETSC) and their subcontractor reviewed data and reports at the Missouri Department of Natural Resources (MDNR) Bridgeton Landfill website. The purpose of the review was to examine available reported data collected at the landfill gas extraction wells (GEWs), gas interceptor wells (GIWs), and temperature monitoring probes (TMPs) to assess the presence and progression of any subsurface oxidation event/heat-generating event occurring in the South Quarry, North Quarry or the adjoining "Neck" area (*see figure on right for an approximate depiction of these areas and the adjacent Westlake Landfill OU-1 cell*). The shaded areas shown in the figure are intended to provide a quick reference to different areas of interest. This report analyzes data primarily collected in May 2016.

The closure of the South Quarry and North Quarry landfill cells was approved by MDNR in 2008 and 2010, respectively. The landfill cells were closed with a 2-ft thick clay cap (with hydraulic conductivity $< 1 \times 10^{-5}$ cm/sec) overlain by a 1-ft thick vegetative soil layer. An ethylene vinyl alcohol (EVOH) flexible membrane cap was placed over the South Quarry, Neck Area, and a portion of the North Quarry in 2013 and 2014. Work was initiated in the South Quarry at various times in 2014 and 2015 to repair slopes that had subsided. A North Quarry cap enhancement project (approved by MDNR on 27 January 2016) was recently initiated, which includes installing a flexible membrane liner between the edge of the EVOH liner and the perimeter road, along with associated stormwater management and gas management infrastructure. As reported in the *May 2016 Monthly Report*, 13 new GEWs began operation and collecting data in the South Quarry while two new GEWs began operation in the North Quarry.

This document provides a summary and discussion of data collected in North Quarry, Neck Area, and South Quarry of the landfill. Observations on the flare data are also provided below:

- The average flow rate of CH_4 (257 standard cubic feet per minute (scfm)) from the flare was slightly more than in April (242 scfm) and the flare-measured flow of CO_2 (1,103 scfm) was slightly more than in April (1,056 scfm). The balance gas flow rate of 1,207 scfm in May 2016 was more than in April 2016 (1,185 scfm).
- The average total flare flow rate of 2,734 scfm in May was slightly more than the average total flare flow rate in April (2,700 scfm).

Flare data are subject to further examination, as subsequent meetings in December 2015 and January 2016 indicated the flow measurements for the overall gas collection system and flares

were not accurate, and flow data for the mentioned systems were not accurately measured until after March 12, 2015 (per MDNR). However, it is our understanding that flow data from individual GEWs and GIWs were accurate throughout 2015 and into 2016.

North Quarry

Temperature

May measurements showed one well (GEW-42R) that had a temperature decrease in the month, but no wells displayed increasing trends. The remaining wells exhibited mostly steady temperatures compared to April data. The maximum temperature measured in North Quarry wells was approximately 129 °F (GEW-51). Two new wells began operation this month (GEW-1A and GEW-2S) and the maximum temperature at these wells was < 100 °F.

Data from several TMPs in the North Quarry (TMP-16, through -18 and -21, through -29) were examined, and the observed temperatures were all generally steady in May. In limited cases (e.g., TMP-16 and -28) uniform temperature declines of about 2 °F were observed at nearly every depth, suggesting a slight change in operational conditions of the resistivity output or measurement device rather than an actual in situ temperature decline.

Three TMPs (-16, -17, and -25) had at least one depth with a measured temperature > 160 °F, which is the same as seen in March and April. TMP-27 had temperatures just below 160 °F at the 80-ft depth but this measurement is generally consistent with historical values that have not exceeded 160 °F. **Temperatures > 160 °F were observed at two depths in TMP-25, but observed temperatures were less than historical highs at these depths (60 ft and 80 ft).**

Collected Gas Quality

May data showed similar historical trends with respect to balance gas, with few wells showing an elevated balance gas concentration. A maximum balance concentration of 78% was measured at GEW-1A, which started operation in May 2016; among the old wells, the maximum balance concentration of 47% was observed at GEW-5. Measured vacuum pressure slightly increased for two wells (GEW-02 and GEW-45R) and the remaining wells remained steady, with the majority of wells exhibiting a low or no vacuum (either < 2" water column [w.c.], or positive pressure) for multiple measurements taken throughout the month. Laboratory data suggest that the balance gas consisted mostly of N_2. Similar to April measurements, nearly all elevated balance gas measurements were accompanied by a low O_2 concentration (< 2%) suggesting possible air intrusion in the wells with elevated nitrogen. The remaining wells exhibited conditions typical of normal anaerobic decomposition.

Settlement

No settlement data were collected for the North Quarry in May.

Neck Area

Temperature

TMP measurements were mostly stable when compared to April data. TMPs showed mostly steady trends with temperature changes generally < 2 °F, with the exception of some TMPs located near the surface (e.g., TMP-2 at 0 ft) that exhibited a slightly larger fluctuation but within historical levels. TMP-10 exhibited a slightly increasing temperature trend at most depths in May. Note that one depth (TMP-11 at 196 ft) that exhibited a large temperature increase of about 48 °F (from 123 to 171 °F) during April 2016 did not have any measurements in May 2016. A note in the May 6, 2016 weekly report suggested that the 196-ft depth had a high resistivity reading and that the temperature measurement was "unreliable". **The 36-ft depth of TMP-11 exhibited the largest temperature measurement to date (173.8 °F).**

May GIW data exhibited fluctuating trends for temperature measurements. Several GIWs exhibited a temperature fluctuation of about 40 °F during May, with final temperature readings in May remaining < 100 °F, except for GIW-1. Generally, such fluctuations are consistent with trends in the past several months. The applied vacuum at all GIWs except GIW-1 and 4 was nearly zero for several measurements in May.

GEWs exhibited mostly steady temperature trends with a small increase at a few locations in May. Applied vacuum remained mostly steady. Although the applied vacuum at most GEWs was low, those wells with a greater applied vacuum (e.g., GEW-10, -54) did not exhibit substantial increasing temperature trends compared to historical values.

Heat Extraction System (HES) Evaluation

TMPs installed adjacent to GIWs retrofitted with the HES (cooling loop system) were examined and compared to April data. The May data displayed a mix of decreasing and increasing temperatures. The TMP-5 HES series (TMP 5-5N (20 to 60 ft) and -9N (40 to 60 feet)) showed a slight increase in average temperature compared to April. TMP 5-5N also showed an increase of more than 5 °F at the 20 ft depth, but the maximum temperature in May was less than the historical high. TMP-5-9S appeared to show a temperature decline at all depths, but the uniform trend suggested the decline may be a function of the measurement devices rather than an in situ temperature change.

TMP-10-5S showed a continued temperature decline compared to April and consistent with temperature declines at five depths since early 2015. The rate of temperature decline (approximately 3 °F at each depth) was consistent with the historical rate of temperature change at this TMP. Measurements at TMP-20 showed a decrease of 2.23 °F at the 100-ft depth, with a halt in the continuous increasing trend at the 140-ft depth noticed since November 2015.

Similar to April, the TMPs continued showing higher temperatures than the adjacent GIWs, and the TMPs closer to the GIW generally had lower temperatures than those farther from the GIWs, indicating a mostly localized cooling effect from the HES.

Collected Gas Quality

Four (GEW-38, -109, -110, -56R) of the 14 GEWs exhibited elevated balance gas concentrations (ranging between about 29% and 69%) at least once in May. Oxygen concentrations in GEW-109 and -56R were low, suggesting possible air intrusion. The other wells generally exhibited anaerobic conditions with balance gas concentrations < 10% and oxygen < 1%.

All 13 GIWs exhibited elevated concentrations of balance gas (ranging between about 13% and 75%) and/or CO_2 (between 4% and 68%). Elevated balance gas concentrations were observed during the entire month and the majority of GIWs had measured concentrations more than 30%, with a maximum of approximately 75% at GIW-12. Few GIWs showed elevated balance gas and elevated oxygen content, suggesting potential air intrusion at the well (GIW -3, -4, -7, -9, -12), while several GIWs (GIW-1, -2, -5, -6, -8, -10, -11, -13) had elevated balance gas but low oxygen content, which suggests possible air intrusion into the waste. CH_4 concentrations were generally < 20% for each GIWs.

Settlement

Limited elevation points were measured in the Neck Area, thus no assessment of settlement rates in the Neck Area is made here.

South Quarry

Temperature

- **No GEWs with data had temperatures at or > 200 °F; 43 wells had measured temperatures ranging from 140 °F to 200 °F (an increase from April); 37 wells had measured temperatures < 100 °F, also an increase from the previous month.**
- **72 wells maintained an applied vacuum of at least 2″ w.c. for the whole month.**
- **Two TMPs (TMP-31 and TMP-32) were examined. Generally, temperatures were steady or slightly increasing, with a notable increase (> 2 °F) at the 200-ft depth at TMP-32, which continues the increasing temperature trend at this location since its construction in early 2015.**

Collected Gas Quality

No GEWs in the South Quarry exhibited gas concentrations consistent with anaerobic waste decomposition conditions.

Settlement

The maximum point-to-point surface settlement depth in May was 1.17 ft; this is less than the monthly settlement analyzed in March and April (1.35 ft). The volumetric change in the landfill, computed as the difference in surfaces created by individual elevation points in May and April, was estimated using a computer-aided design program. The analysis showed a volume decrease of approximately 10,501 yd^3 from April to May. This is a large decrease from the estimated 18,000 yd^3 volume loss from March to April This value should be considered an estimate since there were a larger amount of settlement points missing from this month's data and details on surface filling or removal activities were not available in the site's monthly report narrative.